

3.13 Fire Risk and Fuels (Air Quality)

3.13.1 Summary

Border Project Alternative 2 responds best to reducing large wildland fire risk and maintaining a high level of safety for life and property. Alternative 2 would return 3,089 high and medium risk acres to the low fire risk category. This is 444 acres more than Alternative 3 and 3,089 acres more than Alternative 1. Therefore, implementing Alternative 2 would best reduce wildland fire risk and maintain a high level of safety for life and property.

3.13.2 Introduction

Fuels reduction was not identified as a significant issue in comments received from the public during the scoping period for the Border Project. However, the Project's purpose and need included a concern that increasing fuel loading across the Forest would lead to an increasing risk of large wildfires occurring within the wildland/urban interface areas. Risk is based on a variety of factors including ignition sources, weather patterns, and spatial distribution of vegetation in conjunction with the location of human developments. This section examines the current fuel conditions that indicate the relative risk of wildfire in wildland/urban interface areas.

3.13.3 Analysis Methods

Indicator 1

Fire Risk Index

The Fire Risk Index provides a general characterization of fire risk over time and highlights the differences among alternatives by using a simple qualitative index that characterizes fire hazard based on species composition, age, and fuel characteristics. Stands were divided into three fire risk classes (high, medium, and low) based on species, age class, and treatment history. Low Fire Risk areas are lowland conifers and forest types more than forty years old that have been thinned. Medium Fire Risk areas consist of untreated grasslands, hardwoods, and mixed conifer/hardwood types that are more than forty years old. High Fire Risk areas consist of untreated upland conifer more than forty years old. The analysis compares the amount of acres treated under each alternative. See Forest Plan 2004, Final Environmental Impact Statement (FEIS), p.3.5-4.

3.13.4 Analysis Area

The Analysis Area for considering direct and indirect effects includes all National Forest System (NFS) land within the Border Project area boundary. The Analysis Area for considering cumulative effects is also the Project area, but includes all land ownerships. The boundary of the Project area was selected because direct and indirect effects from treatments would be limited to the Project area. The analyses for the direct, indirect, and cumulative effects are based on a ten-year period, which is commensurate with the anticipated completion of NFS treatment activities such as timber sales and subsequent reforestation.

3.13.5 Affected Environment

Historically, fire has been the major disturbance agent affecting the landscape within the Project area. Fire helped establish, maintain, and convert the historical vegetation of the area depending on the frequency, intensity, and patch-size of the fire event. Since the early 1900s, fire suppression and the lack of vegetative management that addresses historic native communities have resulted in a high percentage of forest communities that are altered from their natural range and are at risk of losing key ecosystem components.

Fire suppression has allowed shade tolerant species such as balsam fir to establish and proliferate in the understory of upland forest types. Decades of fire exclusion has resulted in a change in species composition, higher fuel loadings, an increase in ladder fuels, and a severe departure in the frequency and intensity of fires that would have occurred here historically.

Fuel and Fire Behavior Characteristics

Wildland fire behavior is highly influenced by forest fuel types, weather, and topography. Forest fuels consist of organic matter, including both dead and living material. Dead fuels consist of grass, needles, leaves, twigs, branches, and logs, and are primarily found on the forest floor. On the other hand, live fuels consist of the foliage of the forbs, shrubs, brush, and trees. In Minnesota, conifer foliage is the primary live fuel of concern because it contains enough resins to sustain fire under normal burning conditions. Broadleaf foliage, including brush and shrubs, will support a fire only when it has been thoroughly dried out by severe drought conditions.

When conifer foliage extends from an area close to the ground up into the overstory canopy, the potential exists for fire on the forest floor surface to move up into the overstory through “torching” or “passive crown fire.” In passive crown fires, single trees or groups of trees may burn at once, but solid, moving flame is not maintained in the canopy. If the crown foliage is not contiguous, either because of gaps or because non-coniferous trees are interspersed within the majority of the overstory, or if wind speed is not great enough to maintain active flames in the canopy, crown fire would not be sustained. However, if the coniferous foliage is contiguous, and the wind speed is sufficient, an “active” crown fire is likely.

Crown fires present special problems (Scott and Reinhardt 2001) to managers because they:

- Spread several times faster than surface fires
- Have frequent spotting, which can occur over long distances and can ignite new fires ahead of the main fire
- Have longer flame lengths and greater intensity, which make suppression by ground forces impossible and require larger firefighter safety zones
- Produce greater heat radiation, which makes it more difficult to defend structures than with surface fires
- Produce effects, which are more severe and lasting than surface fire, including near total tree mortality, greater smoke production, and greater loss of foliar nutrients from the site

Fire Occurrence

Historically, fires occurred in the area with regularity, as evidenced by the frequency of pine types within the Project area and the presence of fire scars and char throughout the Project area. There have been three wildland fires within the past six years in the Project area. The Myrtle Lake Fire burned 20 acres in 2008, the Vermilion Gorge Fire burned two acres in 2007, and the East Bay Fire on Crane Lake burned 0.5 acres in 2002. The effects of these fires were short-term and lasted only for the duration of the fire suppression activity. Fuel loading was slightly reduced as these fires mainly consumed ground litter. Further, none of these fires changed the forest type or age class.

Values at Risk

Residential areas occur primarily around the perimeter of the Project area at Buyck, Crane Lake, Echo Lake, and along the Vermilion River. In addition, there are homes, seasonal cabins and resorts scattered throughout the Project area with higher densities around small lakes such as Johnson Lake, Long Lake and Moose Lake. The Superior National Forest maintains a picnic area and toilets at Vermilion Falls, a hiking trail along the Vermilion Gorge, and a campground at Echo Lake.

3.13.6 Environmental Consequences

3.13.6.1 Direct and Indirect Effects

Alternative 1 (No Action)

Indicator 1

Fire Risk Index

Under Alternative 1, no timber harvesting or fuel reduction activities would occur to reduce the number of acres available to support high intensity wildland fires. The acres in the high, medium, and low categories would remain at their current levels (Tables 3.13.1, 3.13.2, and 3.13.3). However, acres available to support wildland fires would increase over time.

Acres in the high risk category would increase as young upland conifers grow over forty years old. Some medium risk acres would also move into the high risk category. Mature upland hardwood acres subject to severe wind events would naturally succeed to an upland conifer component. Typically, mature aspen and birch stands have sizable amounts of balsam fir and white spruce in their understories. Once the aspen or paper birch overstory is removed by windstorms or natural mortality, the suppressed balsam fir and white spruce is released and allowed to grow into the overstory.

Alternative 1 would increase the potential to lose key components of certain ecosystems. The exclusion of timber harvesting and fuel reduction activities would allow balsam fir to invade and proliferate in the understory of most stands. Further, balsam fir already present would continue to grow into the overstory, making stands that are currently vulnerable to passive crown fires more likely to experience active crown fires in the future. Additionally, surface fires initiating within these stands or spreading into these stands from adjacent stands would be more likely to transition into crown fires, which

would result in mortality to some trees in the stand. Fire fighting forces would be at greater risk in trying to suppress these fires due to the high intensities and rapid spread rates characteristic of crown fires. Because a greater proportion of the landscape would be susceptible to crown fire, the threat to surrounding residences and communities would be correspondingly greater because firefighting efforts would not be as effective against crown fires as against surface fires. Accordingly, the fuel hazards would steadily increase with time until a natural or human cause disturbance changes the fuel type, fuel loading, fuel continuity, or fuel arrangement.

Because Alternative 1 does not treat any units, this alternative presents the greatest risk of crown fires from a wildland fire than all of the other alternatives.

Direct and Indirect Effects Common to Alternatives 2 and 3

Indicator 1 Fire Risk Index

The treatment activities proposed in Alternatives 2 and 3 that would affect the amount of acres available to support wildland fires include timber harvesting and fuel reduction activities. The amount of timber harvesting proposed under each alternative would account for the majority of the acres becoming unavailable to support high intensity crown fires by changing the horizontal and vertical fuel structure in the stand. Although no treatment activity can prevent the occurrence of wildland fires, timber harvesting and fuel reduction treatments can help reduce the potential for high-intensity wildland fires (USDA Forest Service, 2007 Superior National Forest Monitoring Report, Fire and Fuels, p. 30).

Stands may require one to three treatments to effectively reduce the fuel type, loading, and arrangement within a treatment unit. These treatments may include prescribed fire or timber harvesting separately, or a combination of these treatments. A post treatment evaluation would be completed after each treatment to determine if objectives were met or if an additional treatment should be considered. Some units treated only with prescribed fire may need to be burned multiple times because fuels and burning conditions are not consistent throughout the stand. For example, areas with blowdown or pockets of heavy fuel loading may be burned under higher humidity conditions to prevent intense fire activity. Under humid conditions, fire may not carry in areas with lesser fuel loadings.

A second burn may be conducted under drier conditions to burn areas not treated in the first burn. Thinning or final harvesting a treatment unit prior to prescribe burning would increase the effectiveness of the burn. The harvesting would remove most ladder fuels from the treatment area and prevent crown fires from initiating. In addition, the removal of fuels below the canopy would lower the intensity of the fire and prevent heat from scorching the canopy. The harvesting can also remove tree species such as paper birch that are known to loft fire brands into the air when they burn. These fire brands can start spot fires across the fire control line. Harvesting would also extend the length of time (burn window) to burn an area. Timber slash would generate more available fuel for burning and help carry the fire. Fuels in a harvested area can be dried out more readily than fuels under an enclosed canopy because the fuels are exposed to wind and sun.

Alternatives 2 and 3 would utilize even-age, intermediate and non-harvest restoration techniques. Each harvest method would affect fire behavior the same, but to varying degrees based upon the amount of available fuels (wood) extracted from the site. Fuel loading would be reduced by removing fuels (merchantable wood) from the site and burning incidental slash (i.e. branches and tops) piles at the landings. Some finer fuels may be masticated during the logging operation and become unavailable for burning. Harvesting would change the fuel continuity within a treatment area by removing vegetation and creating gaps in the canopy. Fires would be restricted to surface fires with some individual tree torching occurring. The lack of contiguous vegetation in the overstory would discourage active crown fires from occurring. Gaps in the canopy would be more evident in areas prescribed for a final harvest versus a thinning prescription because more vegetation is removed in a final harvest.

From a landscape context, fuel contiguity would be changed by utilizing the harvested unit as a break in fuel types. Roads and landings within the harvested units would also serve as a break in fuel contiguity. Harvesting would change fuel arrangement by removing ladder fuels which decreases the vertical contiguity between surface fuels and canopy fuels (Graham and others, 2004). The vertical fuels would either leave the site as a merchantable product or would be placed on the ground. Fuel arrangement would also be changed as harvesting equipment crushes slash, woody debris, and small diameter balsam fir ladder fuels to the ground during the harvesting process.

Air Quality

Alternative 1 does not include any proposed burning activities. Alternatives 2 and 3 include a proposed underburn about 2.5 miles west of the Crane Lake community and near the Voyageur Snowmobile Trail (248 acres). Alternative 2 also includes a proposed underburn near Johnson Lake (110 acres). In addition, Alternative 2 would create about 100 timber sale brush disposal piles (about 2,000 acres) and Alternative 3 would create about 90 timber sale brush disposal piles (about 1,800 acres).

If mechanical treatments or biomass recovery techniques are possible at the time of implementation, the underburns and pile burning may not occur. However, for the purposes of this analysis, it is assumed these fuels reduction treatments would occur with prescribed fire and would have affects to air quality.

The effect of the smoke from the burning activities associated with this Project would be negligible to people downwind. The primary proposed fire activities involve two underburns and a number of pile burns. The difference between Alternative 2 and 3 is that Alternative 3 includes only one of the underburns and fewer piles to burn. The underburn near the Voyageur Snowmobile Trail would not exceed a value that approximates the form of the EPA health standard (using the Forest's screening analysis for prescribed burns). This is also based on the proposal to burn the 248 acre unit in four equal blocks on four different days and likely four different years.

Also, the underburn in the vicinity of Johnson Lake would not exceed a value that approximates the form of the EPA health standards (using the Forest's screening analysis for prescribed burns). This is based on the proposal to not burn if the wind is blowing towards the resort on Johnson Lake.

Timber sale brush disposal pile burning exhibits more complete combustion (and hence also produces fewer emissions) since more of the burning happens in the flaming phase than the smoldering phase (NWCG, 2001). Using standard Forest Service and EPA modeling tools and worst case assumptions, smoke coming from one of the piles was modeled and shown to have the no potential to exceed a value that approximates the form of the health standards. Even if multiple piles were burned at the same time and their smoke plumes overlapped, impacts would be below this same level.

Effects to Areas of Concern to the Public

None of the fuel reduction treatments are located near the BWCAW and they would not affect resource and social conditions in the BWCAW. No fuel reduction treatments would occur adjacent to Voyageurs National Park (VNP) in Alternative 2. However, Alternative 3 would treat two units about one-half mile from VNP. Both units are located near Johnson Lake. The first unit would thin a red/white pine stand and then broadcast burn the slash. The second unit would final harvest a jack pine stand and then burn the slash piles at the landing. The smoke would not affect most visitors to the VNP because the majority of the VNP use is associated with the travel corridor on Namakan Lake which is located over five miles from the units. There are no campsites or day use sites located on Johnson Lake on VNP land. One fuel reduction treatment (prescribed burn) is located within three miles to the west of the Crane Lake community. People in the community may smell smoke from the prescribe burns, but would not be subjected to emission exceeding any health standard due to the small size of the burn, a prescribed wind direction that pushes smoke away from the community, and the distance from the treatment area to the community which would disperse smoke concentration. People around Crane Lake may smell a higher concentration of smoke the next morning if weather conditions channel smoke down the Vermilion River during the night and settles onto Crane Lake.

Alternative 2

Indicator 1 Fire Risk Index

Alternative 2 would treat more available acres in the high risk category and medium risk category than Alternative 3 (Tables 3.13.1, 3.13.2, and 3.13.3). Approximately 769 high risk acres and 2,320 medium risk acres would be treated through timber harvesting and fuel reduction treatments. Susceptibility to crown fire would be decreased the greatest of all of the alternatives; therefore, threats to firefighters and public safety would be less than the other alternatives. Hand crews would have a greater chance of suppressing wildland fires because the fire intensities and spread rates are reduced substantially in surface fires. The potential risk of wildfire would be the lowest with Alternative 2 since the largest number of acres would be treated under this alternative.

Alternative 3

Indicator 1 Fire Risk Index

Alternative 3 would treat the second highest amount of available acres in the high risk and medium risk categories among all alternatives (Tables 3.13.1, 3.13.2, and 3.13.3).

Approximately 377 high risk acres and 2,268 medium risk acres would be treated through timber harvesting and fuel reduction treatments. Susceptibility to crown fire would be decreased more than Alternative 1 but less than Alternative 2. Thus, threats to firefighters and public safety would be less than Alternative 2 but more than Alternative 1. Hand crews would have a greater chance of suppressing wildland fires because the fire intensities and spread rates are reduced substantially in surface fires. The potential risk of wildfire would be the second lowest with Alternative 3 since the second largest number of acres would be treated under this alternative.

Table 3.13.1 High Fire Risk Acres after Treatment Displayed by Ownership and Alternative				
Land Manager	Current Condition	Alt. 1 (2014)	Alt. 2 (2014)	Alt. 3 (2014)
National Forest System	20,008	21,452	19,239	19,631
State of Minnesota	1,584	1,563	1,563	1,563
St. Louis County	1,910	1,794	1,794	1,794
Private Landowners	4,990	4,990	4,990	4,990
Total Acres	28,492	29,799	27,586	27,978

Table 3.13.2 Medium Fire Risk Acres after Treatment Displayed by Ownership and Alternative				
Land Manager	Current Condition	Alt. 1 (2014)	Alt. 2 (2014)	Alt. 3 (2014)
National Forest System	14,721	12,878	12,401	12,453
State of Minnesota	2,735	2,715	2,715	2,715
St. Louis County	2,682	2,639	2,639	2,639
Private Landowners	3,617	3,617	3,617	3,617
Total Acres	20,138	21,849	21,372	21,424

Table 3.13.3 Low Fire Risk Acres after Treatment Displayed by Ownership and Alternative				
Land Manager	Current Condition	Alt. 1 (2014)	Alt. 2 (2014)	Alt. 3 (2014)
National Forest System	22,584	22,983	25,673	25,228
State of Minnesota	3,132	3,173	3,173	3,173
St. Louis County	4,722	4,880	4,880	4,880
Private Landowners	2,040	2,040	2,040	2,040
Total Acres	32,478	33,076	35,766	35,321

Conclusion – Direct and Indirect Effects

Indicator 1 Fire Risk Index

Alternative 2 treats the most acres at risk for wildland fires among the alternatives. This is due to the number of acres treated through timber harvesting and fuel reduction

treatment activities. Alternative 2 would return 3,089 high and medium risk acres to the low fire risk category. This is 444 acres more than Alternative 3 and 3,089 acres more than Alternative 1. Therefore, implementing Alternative 2 would best reduce wildland fire risk and maintain a high level of safety for life and property. Forest Plan Operational Standards and Guidelines (Appendix B) and guidelines in the Prescribed Burn Plan included with all action alternatives would provide direction to limit or eliminate the potential for adverse effects to sites during implementation.

3.13.6.2 Cumulative Effects

The effects of human interruption of the historical frequent low-intensity fires through systematic organized fire suppression on all ownerships in the Project area have led to an increase in the amount of fuel, both living and dead, that is available to burn should a wildfire occur. Consequently, shade tolerant conifers have proliferated in the understory of stands and have increased their susceptibility to crown fires. Under Alternative 1, this fuel buildup would continue. Under Alternatives 2 and 3, some reduction in this fuel build up would occur.

The number of acres treated by the State of Minnesota, St. Louis County, and private land owners would not change relative to the Border Project alternatives. The effects of these treatments would be similar to those described in the environmental consequences section, but to a greater scale due to the increase in acres being treated. The cumulative effects are discussed below.

Commercial timber harvesting has been and will be the primary mechanism to influence fire risk rankings on NFS, State, county, and private land in the past, present, and the foreseeable future. In the past ten years, Forest Service, State, county, and private landowners have harvested 2,755 acres, 754 acres, 1,284 acres and 121 acres respectively, within the Project area. In addition, on NFS land hazardous fuels reduction has occurred on approximately 361 acres through release work using brush saws. The Forest Service also plans to reduce fuels on four areas totaling 1,285 acres using prescribed fire. These acres are reflected in the current condition columns in the preceding tables.

The State of Minnesota and St. Louis County plan to harvest 174 acres and 541 acres respectively, in the next ten years. These acres are predominantly an aspen forest type and would move from the medium risk category to the low risk category. A very small number of acres would succeed into the higher fire risk categories because their current forest types, age and condition would keep them in their current category for the next ten years. The State of Minnesota Division of Wildlife has not conducted any prescribed burning in the past five years and does not anticipate any burning within the next five years (Pers Comm. P. Backman, MN DNR).

Harvest on private land is unlikely in the near future. Aspen is the primary forest type on private land. Any harvesting would move these acres from the medium risk category to the low risk category. No acres would succeed into the higher fire risk categories because their current age and condition would keep them in their current category for the next ten years.

Voyageurs National Park has conducted 17 prescribed burns totaling 1,471 acres in the past 10 years. They are planning to burn 15 units for 2,468 acres within the next four

years. The past burns have all stayed within their designated control points. Smoke emissions from the past burns did not exceed any health standard to sensitive receptors in the Project area due to the small size of the burns, a prescribed wind direction that pushes smoke away from the sensitive receptors, and the distance from the treatment area to the sensitive receptors which would disperse smoke concentration. Therefore, future burns would have the same characteristics as mentioned above and therefore, would not affect any sensitive receptors in the Project area. The Park had four lightning fires that were managed as a Wildland Fire Use. The Section 33 fire was the largest at 1,435 acres. However, smoke from this fire tracked to the northeast and did not affect any sensitive receptors in the Project area.

The prescribed burning activities in Alternatives 2 and 3 would not add to the cumulative impacts from other on-going prescribed burning projects in the Project area. Pile burning usually occurs from early October to the second week in November when no other types of burning can occur because of the wet weather patterns. As these prescribed burns would be implemented by Forest Service personnel, the timing of these burns would be highly coordinated. Consequently, the likelihood of their emissions impacting the same area simultaneously would not be great. Likewise, the limited amount of prescribed burning and the emissions released from prescribed burning on VNP, State, county and private land would be coordinated and would not cumulatively impact air quality.

When applicable, the State, county, and Forest Service agencies have planted conifer species (mainly red and white pine) in the past to increase this component in the local area. It is expected that flammability of the forest fuels will temporarily increase in tandem with the increase in the total acreage of young-aged pine; however, flammability will decrease as the pine reaches maturity. In addition to the timber harvesting and fuel reduction treatments proposed, there are also a number of timber stand improvement projects using mechanical methods occurring on other ownerships. While some of these projects are intended primarily to release pine regeneration from competing vegetation such as balsam fir, this would have an added fuel management benefit in removing some of the conditions that lead to crown fire initiation.

Although prescribed burning and mechanical treatments would have the effect of reducing fuels in the Project area, fire suppression on all ownerships is expected to continue. As a result, fuel buildup would continue to occur in untreated stands.

The ownership is mixed throughout the Project area. The mixed ownership has caused the fire risk of stands to be altered throughout the entire Project area. In some cases, treatments have occurred on different ownerships adjacent to each other. This has allowed a greater portion of the landscape to be treated.

The activities that have occurred or are occurring on all ownership are returning the Project area to a healthier condition. Based on past, present and reasonably foreseeable future actions, it is unlikely that implementing any of the two action alternatives would result in an adverse cumulative effect. No activities are proposed in Alternative 1 to reduce or maintain acres in a lower fire risk category. Alternative 1 would allow stands to move into higher fire risk categories over time and would increase the risk of losing key ecosystem components.